

In the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A method of automatically focusing a microscope having a light source, an objective lens, a light path to direct incident light through the objective lens to be reflected by ~~the~~an object, an aperture to limit the spatial extent of the incident light and serve as an illumination pupil, a light path to direct at least some of the reflected light to an imaging system, and an imaging system to image the reflected light so directed, the method comprising: directing a beam of light from a light source through an objective of a microscope system to an object whereby light is reflected from the surface thereof; collecting at least some of the light reflected thereby and directing the same to an imaging system, wherein the incident beam of light is limited in spatial extent by imaging an aperture to form an illumination pupil, a centroid of illumination of the illumination pupil is aligned with an incident optical axis ~~of the instrument~~, and reflected light is projected to the imaging system in which the reflected light is split into comprising at least two images from eccentric sections of an imaging pupil differentially displaced from the optical axis, and wherein the separation of the images thereby produced is determined to provide an indication of ~~the object distance a~~ focus condition.

2. (Original) The method of claim 1 wherein an illumination beam is injected into the top focal plane of the objective limited in its spatial extent and bounded by imaging an aperture so as to form an illumination in the top focal plane of the objective.

3. (Currently Amended) The method of claim 2 comprising the formation of a plurality of images of the object using sections of the imaging pupil with differing eccentricities and projecting the images onto a single imaging means within the imaging system.

4. (Currently Amended) The method of claim ~~4~~3 wherein the imaging means comprises a single detector array.

5. (Currently Amended) The method of claim 1, further comprising successively repeating ~~the actions stages of any preceding claim~~ to obtain separate pairs of images from eccentric sections of the imaging pupil, measurements of the separation of the successive pairs of

images being used as part of iterative process to improve the accuracy of the focus condition focusing information and/or to obtain focusing information varying spatially across an object, particularly to accommodate a degree of deviation from planarity.

6. (Currently Amended) The method of claim 1 wherein the light source that is used to produce the light beam that is reflected and directed to the imaging system for the focus investigation is derived from the same light source as the light which is used for metrology.

7. (Currently Amended) The method of claim 1 wherein a beam splitter is used in order to extract light reflected from the object sample and direct the same towards the a focus optical system and imaging system adapted to investigate the focus condition, and a primary observational optical system, the imaging system focus optical system being separate from the primary observational optical system which is used to image the object, obtain metrology data or other measured data therefrom, once the focus has been determined.

8. (Currently Amended) The method of claim 1 comprising a first investigating the focus condition and subsequently conducting observation and/or measurement of the object via a single optical system with a common imaging means.

9. (Currently Amended) The method of claim 1, further comprising using image separation by a dihedral mirror arranged so as to simultaneously split the imaging pupil into the at least two images formed on and redirect the light from the two portions to different sections of an imaging means within the imaging system.

10. (Currently Amended) The method of claim 1 wherein a field stop is provided as the aperture to limit the spatial extent of the incident light in the illumination beam of light from the light source.

11. (Canceled)

12. (Currently Amended) A microscope auto-focus system comprising:
a light source;

an objective lens system, and a first light path to direct incident light from the light source through the objective lens to be reflected by an the object;

an aperture that limits to limit the spatial extent of the incident light and serve serves as an illumination pupil with the centroid of illumination from the illumination pupil on an the optical axis;

an imaging system and a second light path to direct reflected light from the object to ~~an the imaging system, and an the imaging system comprising, and the system further~~ comprises optics to split the project-reflected light into to the imaging system comprising at least two images from eccentric sections of an imaging pupil differentially displaced from the optical axis, and a camera to measure the separation of the images thereby produced to provide an indication of ~~the object distance~~ a focus condition; and

a control system ~~optics to adjust mechanically the separation of the object being~~ observed from the imaging objective lens, under the control of the focus system.

13. (Currently Amended) A microscope auto-focus system in accordance with claim 12 wherein a ~~first optical and the~~ imaging system is provided for focus images to be used to determine optimal focus position in a first focusing step, the microscope comprising and a second ~~optical and imaging system is provided for an observational image to be used in a~~ subsequent observational (for example petrology) step, and with a beam splitter and/or ~~selective optics disposed between the imaging system and the second imaging system~~ therebetween to divert reflected light from the an object selectively to either imaging system and/or partially to both the imaging system and the second imaging system.

14. (Currently Amended) A microscope auto-focus system in accordance with claim 12 wherein the optics means to split the project-reflected light into to the imaging system ~~comprising at least two images from eccentric sections of the an imaging pupil includes image~~ separation optics comprising comprises a dihedral mirror.

15. (Canceled)

16. (New) The method of claim 5, further comprising obtaining the focus condition varying spatially across an object to determine a degree of deviation from planarity.

17. (New) A microscope in accordance with claim 12 wherein the imaging system is provided to determine optimal focus position in a first focusing step, the microscope comprising a second imaging system for subsequent observational step, and selective optics disposed between the imaging system and the second imaging system to divert reflected light from the object selectively to either the imaging system or the second imaging system.

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